0143-0473-6PCT

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF :

Daniel CELERIER, et al. : EXAMINER: JIMENEZ, M.

SERIAL NO: 09/402,472 :

RCE FILED: December 2, 2002 : GROUP ART UNIT: 3726

FOR: INTERNAL COMBUSTION ENGINE EXHAUST DEVICE AND METHOD FOR MAKING SAME :

APPEAL BRIEF UNDER 37 C.F.R. § 1.192

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

In response to the Final Office Action dated January 16, 2003, and the Advisory Action dated May 1, 2003, the Appellants herein appeal the final rejection of Claims 8-11, 13-16, 18, and 19.

I. REAL PARTY IN INTEREST

The real party in interest is Renault of Boulogne Billancourt, France.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

III. STATUS OF CLAIMS

Claims 1-7, 12, and 17 have been canceled. Claims 8-11, 13-16, 18, and 19 are active, finally rejected, and appealed.

IV. STATUS OF AMENDMENTS

All amendments have been entered.

V. SUMMARY OF THE INVENTION

The present invention relates to an exhaust device for internal combustion engines and a process for making the exhaust device. More particularly, the present invention is directed to an exhaust device including an exhaust pipe provided with a housing suitable for mounting a measuring sensor, and the process for making such an exhaust device.

The modern internal combustion engines of motor vehicles are equipped with an electronic control system that adjusts the quantity of fuel injected, the quantity of exhaust gas recirculated, etc. on the basis of preprogrammed strategies and as a function of engine operating conditions. Among the items of information relating to operating conditions are those relating to the composition and/or temperature of the exhaust gases and, more particularly, to the residual oxygen concentration. The items of information relating to the exhaust gases are delivered by appropriate measuring sensors, which are disposed along the path of the exhaust gases.

In the standard case, the measuring sensors used to measure the exhaust gases are screwed into internally threaded housings traversing the wall of the exhaust pipe. In view of the

slight thickness of the walls of the exhaust pipes in current use relative to the diameter of the holes necessary to mount the sensor, the internally threaded holes in the standard case are formed by appropriate rings that are attached by welding in openings made through the exhaust pipes.

The Appellants have determined that reliance on welded rings suffers from disadvantages such as a large percentage of defects in assembly and leaktightness. In fact, the heat generated during welding tends to deform the internal threads of the rings, which can have the effect of either preventing the sensor from being screwed in or unscrewed from the threads of the rings. In addition, these deformations affect the leaktightness of the assembly and therefore cause burned gases to leak out or, depending on the operating point of the engine, even air to be sucked in, which is particularly detrimental to the quality of the measurements, especially when the sensor is an oxygen sensor.

According to a feature of the present invention, these problems are addressed by providing an exhaust device where an internally threaded hole is provided in the exhaust pipe, where the hole is made directly through the wall of the pipe without the need for a threaded ring attached by welding. The exhaust device includes a measuring transducer configured to analyze a flow of exhaust gases from the engine, and a pipe element adapted to carry the flow of exhaust gases from the engine. The pipe element includes an integral housing in which the measuring transducer is mounted. The housing includes a threaded hole that extends through a bush extending only through a wall of the pipe element. The bush has an interior portion and an exterior portion, where the interior portion extends further within an interior of the pipe element than the exterior portion extends beyond an exterior of the pipe element.

According to another feature of the present invention, the integral housing is formed in the pipe element from a flow-drilling operation comprising drilling through only a wall of the pipe element with a tool at a speed and a penetration force adapted to cause melting and upsetting of a material of the wall around the tool in proportion to an advance of this tool until a bush of required height and diameter is obtained. A hole is tapped through the bush to form internal threads in the hole, and a measuring transducer is mounted within the housing such that the measuring transducer is configured to analyze a flow of exhaust gases from the engine.

For example, in the exemplary embodiment of Figure 1, the exhaust pipe element 1 is provided on an exhaust line of an internal combustion engine. The pipe 1 is equipped with a housing 2 for a measuring sensor, such as a lambda oxygen sensor. The process of forming the housing 2 is described with reference to Figures 2 and 3. In Figure 2, a flow drilling operation is performed using an ogival mandrel or punch 4, which is rotated at high speed (e.g., in excess of 500 rpm, and preferably between 3000 and 5000 rpm) and driven into the pipe with a certain penetration force. The contact between the rapidly rotating tip of the mandrel 4 and the pipe 1 produces a large local temperature rise, which transfers the metal of the pipe to the plastic state. The thrust exerted by the driven mandrel 4 causes it to penetrate progressively through the wall of the pipe 1 to form a hole. The metal flowing in the feed direction of the mandrel 4 forms a neck formed on an interior side of the pipe 1, and the metal flowing in a reverse direction forms a flange on an exterior side of the pipe. A collar 41 situated on an upper part of the mandrel 4 turns down the metal flowing in the reverse direction, thus giving the flange a planar surface, which facilitates support and leaktightness of the sensor 3.

The result of the flow drilling operation is an accurately sized hole 21 prolonged by a

bush 22. The interior neck portion of the bush 22 extends further within the interior of the pipe 1 than the exterior flange portion of the bush 22 extends beyond the exterior of the pipe 1.

A chipless thread tapping operation is then performed on the hole 21 to form threads 23 by deformation of the material of the bush 22.

VI. ISSUES

The issues to be considered in this appeal are whether Claim 8 is obvious over U.S. Patent No. 4,526,672 (Reed) in view of U.S. Patent No. 3,429,171 (Feher), whether Claims 9-11 are obvious over Reed in view of Feher and further in view of page 2, line 4, of the present application, whether Claims 13, 14, 16, 18, and 19 are obvious over Reed in view of Feher and further in view of U.S. Patent No. 5,984,138 (Olson), and whether Claim 15 is obvious over Reed in view of Feher and Olson, and further in view of page 2, line 4, of the present application.

VII. GROUPING OF CLAIMS

Claims 8-11 stand or fall together. Claims 13-16, 18, and 19 stand or fall together.

VIII. ARGUMENT

Independent Claim 8 recites an exhaust device that includes, among other features, a bush having an interior portion and an exterior portion, where the interior portion extends further within an interior of the pipe element than the exterior portion extends beyond an exterior of the pipe element. Independent Claim 13 recites a process of making an exhaust device that includes, among other steps, a step of forming an integral housing in a pipe element

including obtaining a bush having an interior portion and an exterior portion, where the interior portion extends further within an interior of the pipe element than the exterior portion extends beyond an exterior of the pipe element. Claim 8 stands rejected under 35 U.S.C. § 103 as being obvious over Reed in view of Feher, and Claim 13 stands rejected under 35 U.S.C. § 103 as being obvious over Reed in view of Feher and further in view of Olson. As noted in the Official Action dated January 16, 2003, the Examiner has recognized with respect to both Claims 8 and 13 that Reed does not disclose a bush having an interior portion that extends further than an exterior portion (page 3, last paragraph, and page 5, second paragraph). However, the Examiner alleges that Feher teaches a bush 78 having an interior portion 82 extending further than the exterior portion 102. (Page 4, first paragraph, and page 5, third paragraph.) The Examiner alleges that it would have been obvious to one of ordinary skill in the art, at the time of the invention, to have provided the invention of Reed with a bush with an interior portion that extends further than the exterior portion, in light of the teachings of Feher, in order to provide a stronger structural support for the measuring transducer. (Page 4, second paragraph, and page 5, fifth paragraph.) Regarding the rejection of Claim 13, Olson is cited for the teaching of a flow-drilling operation to form a bush 18. (Page 5, fourth paragraph.)

The Appellants submit that inventions described in Feher and Olson should not be combined with the invention described in Reed. The Appellants submit that Reed relates to a field of art that is separate and distinct from the inventions of Feher and Olson that one of skill in the art would not have looked to at the time of the conception of the present invention. The Appellant recognized that a need existed in the exhaust sensor mounting art, and provided an invention that had not previously been conceived of in the exhaust sensor mounting art in order to provide a structure and method that produce advantageous results over other structures in the

exhaust sensor mounting art. This is evident from a review of the references of record that relate to the mounting of sensors in exhaust pipes, and from the statements provided by Alain Pierdet in the Declaration under 37 CFR 1.132 filed on December 2, 2002. The inventions described in Feher and Olson do not relate to the exhaust sensor mounting art and such technologies had not been utilized in the exhaust sensor mounting art as is evident from a review of the references of record that relate to the mounting of sensors in exhaust pipes, and from the declaration by Mr. Pierdet.

Mr. Pierdet provided a declaration indicating that the present invention solved a problem that had not been previously solved in the exhaust sensor mounting art. In the declaration, Mr. Pierdet indicated that the aim was to replace the method used until now by Renault involving a built up ring fixed by welding on the exhaust pipe, with a new method providing the same functions at lower cost. The specification of the present application discusses the disadvantages of such welded rings such as a large percentage of defects in assembly and leaktightness. (See page 2, lines 10-23.) The specification indicates that the heat generated during welding tends to deform the internal threads of the rings, which can have the effect of either preventing the sensor from being screwed in or unscrewed from the threads of the rings. In addition, these deformations affect the leaktightness of the assembly and therefore cause burned gases to leak out or, depending on the operating point of the engine, even air to be sucked in, which is particularly detrimental to the quality of the measurements, especially when the sensor is an oxygen sensor.

In the declaration, Mr. Pierdet indicated that the present invention provides numerous advantages over methods that utilize two different technologies and two different operations, namely boring and welding, to form the boss. The present invention provides a functional boss

at a lower cost, since in the present invention only one manufacturing device is necessary for two operations, namely flow-drilling and flow-boring. The present invention does not require a welding operation to form the boss. The invention allows for the simplification of the organization of the working stations, as well as the equipment. The bonding between the sensor and the exhaust pipe is perfect with regards to the screwing and to the final tightness.

In the declaration, Mr. Pierdet states that it has not been known to use a flow-drilling operation to mount a sensor in an exhaust pipe of an engine. The flow-drilling operation was used for drilling holes in the automobile industry generally, as evidenced by an article entitled "RVI Annonay: le fluoperçage fait gagner du temps" (a copy of this article was attached to the declaration), which describes the use of flow-drilling in the construction of bus bodies, chassis, and seats. However, the formation of a flow-drilled hole and mounting of a sensor therein in an exhaust device for an internal combustion engine is conspicuously missing from this article.

Mr. Pierdet declared that the formation of a flow-drilled hole and the mounting of a sensor therein in an exhaust device for an internal combustion engine satisfied a long-felt and unsatisfied need in the engine exhaust system art. The long-felt and unsatisfied need is evidenced by the generalization of this new method on the whole range of Renault engines. Mr. Pierdet indicated that the proposed solution has been rapidly accepted because it is easy to implement, it is reliable, and it allows a savings of one Euro on each hole. For these reasons, Mr. Pierdet indicates that the invention was currently being used on all Renault engines, rather than the previous method of inserting and welding a screwed sleeve on the exhaust pipe.

The Appellants respectfully submit that the Declaration of Alain Pierdet provides substantial rebuttal evidence of nonobviousness that clearly outweighs the obviousness

rejections of Claims 8 and 13. For the reasons discussed above, the Appellants submit that Claims 8 and 13 are believed to be patentable.

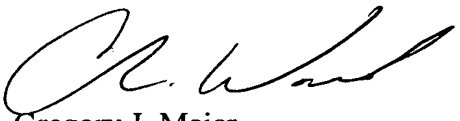
Claims 9-11 are considered allowable for the reasons advanced for Claim 8 from which they depend. The Appellants note that the description on page 2, line 4, of the present application, which is cited in the rejection of Claims 9-11, does not supplement the deficiencies noted above with respect to Claim 8.

Claims 14-16, 18, and 19 are considered allowable for the reasons advanced for Claim 13 from which they depend. The Appellants note that the description on page 2, line 4, of the present application, which is cited in the rejection of Claim 15, does not supplement the deficiencies noted above with respect to Claim 13.

Appellant therefore respectfully submits that all of the claims are patentable, and so requests that the final rejection be REVERSED.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



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APPENDIX

8. An exhaust device for an internal combustion engine, said exhaust device comprising:

a measuring transducer configured to analyze a flow of exhaust gases from the engine; and

a pipe element adapted to carry the flow of exhaust gases from the engine, said pipe element having an integral housing in which said measuring transducer is mounted, said housing including a threaded hole extending through a bush extending only through a wall of said pipe element,

wherein said bush has an interior portion and an exterior portion, said interior portion extending further within an interior of said pipe element than said exterior portion extends beyond an exterior of said pipe element.

9. The exhaust device according to Claim 8, wherein said wall of said pipe element has a substantially uniform thickness of between 1mm and 3mm.

10. The exhaust device according to Claim 8, wherein said wall of said pipe element is made of a stainless metal alloy.

11. The exhaust device according to Claim 9, wherein said wall of said pipe element is made of a stainless metal alloy.

13. A process for making an exhaust device for an internal combustion engine, said process comprising the steps of:

forming an integral housing in a pipe element adapted to carry a flow of exhaust gases from the engine, the housing being formed from a flow-drilling operation comprising drilling

through only a wall of the pipe element with a tool at a speed and a penetration force adapted to cause melting and upsetting of a material of the wall around the tool in proportion to an advance of this tool until a bush of required height and diameter is obtained, wherein the bush has an interior portion and an exterior portion, the interior portion extending further within an interior of the pipe element than the exterior portion extends beyond an exterior of the pipe element;

tapping a hole through the bush to form internal threads in the hole; and

mounting within the housing a measuring transducer configured to analyze a flow of exhaust gases from the engine.

14. The process according to Claim 13, wherein the tool is an ogival mandrel.

15. The process according to Claim 13, wherein the wall of the pipe element has a substantially uniform thickness of between 1mm and 3mm.

16. The process according to Claim 13, wherein the wall of the pipe element is made of a stainless metal alloy.

18. The process according to Claim 13, wherein the speed of the tool is greater than 500 rpms.

19. The process according to Claim 18, wherein the speed of the tool is between 3000 rpms an 5000 rpms.